NASA TECH BRIEF

Langley Research Center

High Field CdS Detector For Infrared Radiation

A new and highly sensitive method of detecting infrared irradiation has been discovered. It makes possible a solid state infrared detector which is more sensitive near room temperature than usual photoconductive low-band gap semiconductor devices. The reconfiguration of high field domains in cadmium sulphide crystals provides the basis for this discovery. This phenomenon occurs when suitably doped CdS crystals, which are biased with a voltage high enough to produce negative differential conductivity, are exposed to infrared irradiation.

CdS platelets are prepared by a vapor transport method in an N_2–H_2S atmosphere and doped by baking at 900°C for three hours while buried in CdS powder containing 50 ppm Ag and Al as nitrates. A Ti-Al electrode is vacuum deposited on the crystal in the form of an arc of a circle. At the center of this arc is placed a gold or tungsten point cathode. Another sharp tungsten probe is placed between the two electrodes to monitor the changes in potential distribution occurring inside the crystal under infrared irradiation. Infrared radiation shrinks the high field domain and, thus, effectively shifts the potential probe into the low field region where the carrier concentration is high. This reduces the contact resistance of the probe and assists in obtaining a large change in the measured potential under infrared irradiation.

The range of the intensity measurement can be affected by altering the position of the potential probe with respect to the electrodes and by extending the high field domain edge, which can be controlled by adjusting the applied voltage. Sensitivity can also be altered by changing the intensity of the band edge illumination. A signal of 900 volts was obtained under infrared irradiation in the $0.8\mu - 1.3\mu$ bands with an intensity of 10^{15} photons/cm^2-sec for 2000 volts applied across the crystal.

Note:

Requests for further information may be directed to:

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Patent status:

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